

APPEARANCE MODIFIER FOR REMOTE DIGITAL VIDEO COMMUNICATION

**EFFECTS OF THE STARTUP ENVIRONMENT ON TECHNOLOGY
EXTRAPOLATED FROM THE EFFECTS EXERTED ON STARTUP ENGINEERS
AND MANAGERS**

An Undergraduate Thesis Portfolio
Presented to the Faculty of the
School of Engineering and Applied Science
In Partial Fulfillment of the Requirements for the Degree
Bachelor of Science in Electrical Engineering

By

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August 12, 2021

SOCIOTECHNICAL SYNTHESIS

Engineering design is an ever-evolving landscape of extraneous variables that influence the performance and perception of those in it. The technical project is a response to the migration of the workplace onto an online medium due to the coronavirus (COVID-19) pandemic of 2019. Due to the online workplace the professional appearance of a user is constrained by the quality of their webcam, which this technical project aims to improve. Present in the science, technology, and society (STS) research topic is an exploration on how the unique financial stress, scarcity of resources, and common work culture in early startups influences engineering design. An outline of all factors present in a startup's workplace is performed in order to correlate the negative effects of each factor with a reduction in performance on engineers' work, which in turn impacts the technology they design. The combination of the technical and STS topic is a direct response to the changing landscape of engineering design, and how the constantly evolving workplace influences engineers' actions and performance.

The solution present in the technical project is a device that directly allows for consistent and complementing lighting for video conferences. It achieves this by actuating a moving ring light based on the haptic feedback generated by the user's head. Haptic data was generated by two Inertial Measurement Units (IMU) being remotely communicated through Bluetooth. The movement in response to this data was generated by two stepper motors such that the face of the user received consistent lighting throughout a video conference. The constructed device was inspired by the Zoom Inc. lighting and video presentation guidelines designed to maximize the visual presentation in remote meetings. In addition, benefits regarding improved presentation with professional performance in a workplace were corroborated with existing research.

The outlined deliverables set forth by in the technical project included the following: (1) Achieve Bluetooth communication facilitating IMU data to motors, (2) achieve motor movement in response to commands, (3) achieve ring light illumination coverage of face, and (4) achieve motor response and protection through limit switches. Ultimately the constructed device did achieve all deliverables with the exception of the first deliverable. While IMU data was generated and transmitted over two Bluetooth modules, the response to these modules was limited due to damage in the printed circuit board (PCB). This damage was due to high currents being generated by the two motors which severed several copper connections. All other functions were intact and shown to work separately.

The STS research topic was an examination on how, and in what way, the challenges in early startups negatively impact the development of the technology they produce. These challenges, and the effects they have on engineers, were then analyzed using Arnold Pacey's Technology Practice framework. To identify the causes behind these challenges social construction of technology (SCOT) was used as a framework to outline relevant groups. In order to relate the startup environment's pressures exerted on engineers, data had to be generated detailing the effects of these pressures. The research accumulated related negative mental and physical health impacts on engineers; providing a basic understanding of the effects of overwork and sleep deprivation frequently seen in startups. Thereafter, research relating to how these negative impacts in turn damage the development of technology was established.

Present in the research, it was found that overwork significantly impacts the physical and mental performance of engineers whether individually or in teams. Seen in engineers are increased tension between teammates, a lack of innovation, and an accumulating number of technical errors in development. The culture present in startups had a focus that lacked ethical

depth and instead based all moral design decisions behind professional or personal experience. Scarce resources compounded this by straining the time and energy engineers had in development. In direct effects on the technology developed were established.

Both technical and STS research topics present a response to the changing context of engineering design. The technical project provided a solution with the appearance in the new remote workplace, while the STS topic developed an understanding of a startup's workplace effects on technology. Both startups and online communication present new challenges that are constantly changing, and through this research an understanding of engineering design's is updated for the modern era.

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